



# Municipal Wireless Solutions

## Improving Citizen Services through Real-Time Access to Information

**Executive Summary** ..... 2

**Mission Value** ..... 3

Improving Public Safety ..... 3

Serving the Citizen ..... 4

Continuing Operations ..... 6

**Solutions Overview** ..... 7

Wi-Fi (802.11) and Cellular Networks ..... 7

Technical Drawing ..... 8

WiMax (802.16) Networks ..... 9

Technical Drawing ..... 10

Mesh Networks ..... 11

Technical Drawing ..... 12

**Partner Solutions** ..... 13

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## EXECUTIVE SUMMARY

**"Many of the countries outpacing the United States in the deployment of high speed Internet services, including Canada, Japan and South Korea, have successfully combined municipal systems with privately deployed networks to wire their countries. As a country, we cannot afford to cut off any successful strategy if we want to remain internationally competitive."**

— U.S. Senator John McCain

Wireless-enabled mobile devices — such as personal digital assistants (PDAs) and laptops — are becoming increasingly common in citizens' everyday lives, allowing them to roam freely while accessing vital information and applications anywhere through a basic, wireless connection to the Internet.

At the same time, local governments are looking to amplify the information processing and sharing capabilities of intelligent mobile devices by implementing municipal wireless networks. The **municipal wireless networks** provide widespread Internet connectivity to select user groups, increasing government workers' mobility and productivity, as well as improving citizen services.

Beyond the immediate operational benefits of these networks, such as service at the point of each citizen, mobile productivity and improved information sharing, other inherent advantages of municipal wireless networks exist. Redundant connection points facilitate continuity of operations in the event of a natural disaster or other emergency situation. Further,

relatively minor additions to these wireless networks by government agencies can dramatically enhance field communications and data usage. Numerous public safety offices are integrating common wired solutions into the wireless networks, such as video surveillance, delivering a powerful, mobile response tool that enables first responders to handle emergency situations with current information and even live feeds to cameras monitoring the incident.

CDW Government, Inc. (CDW-G), a trusted technology provider, delivers solutions that enable state and local governments to reliably and securely deliver critical data and applications through municipal wireless networks. Integrating best-in-class technology products and services from more than 1,000 leading manufacturers, CDW-G offers comprehensive wireless solutions that include best-of-breed components from multiple vendors. CDW-G's municipal wireless solutions provide the wireless technology solutions, backbone support and technical expertise that are key to creating a municipal wireless network.

## MISSION VALUE

### Improving Public Safety

When responding to emergency situations, police officers, Special Weapons and Tactics (SWAT) teams, fire officers and other first responders often have insufficient situational awareness about the actions taking place on the scene. More often than not, departments (e.g., fire or police) have asymmetric information, with each organization responding to just one piece of the overall situation. The limited situational information that is available is traditionally communicated via a single radio band, using shorthand or codes, where only one unit can relay information at a time. In fact, critical information from units not on scene at the emergency must wait, by law, behind radio transmissions from units at the emergency site.

Data flowing over a network fundamentally changes the one-way, one-at-a-time emergency communications model. With wireless devices connected to the municipal wireless network, police and other first responders can leverage Voice over Internet Protocol (VoIP), Instant Messaging (IM), or other customized communication methods to transfer situational information without waiting for a clear radio channel. At the same time, communications are more informational than simple voice transmission, presenting vast data in a single image or diagram.

In Leawood, Kansas, for example, police department dispatchers send calls directly to rugged Panasonic Toughbook® laptops in police patrol cars and other marked vehicles, ensuring that officers have accurate and complete

information — all within their line of sight. In addition, communications and cooperation among surrounding jurisdictions have significantly improved, as Leawood officers and those in several adjacent communities also use Intergraph Public Safety's Computer Aided Dispatch System. This system enables participating jurisdictions to view each other's calls on screen and respond in a more coordinated and rapid manner to evolving emergency situations.

For police officers, Emergency Medical Technicians (EMTs) and other first responders in communities leveraging wireless networks and intelligent mobile devices, messages sent from the command center to units in the field can include site maps and detailed suspect or patient information, as well as other pertinent data that could improve the first responders' abilities to assess and respond to situations. A description of a suspect may be helpful, but an actual picture arms responders with real information to protect and serve the public. Likewise, patient vital signs are useful, but medical histories, including allergies and previous incidents, help turn life-or-death situations into life-saving opportunities.

"Having the laptops in our squad cars has changed how we work," said Jack Reece, information systems specialist for the Leawood Police Department. "Officers can run license plates without having to call the dispatcher, and they can monitor where other officers on a call are located. As a result, our safety, productivity and cooperation have reached new highs."

CDW-G technical experts also can integrate other technology components into the network, such as Global Positioning System (GPS) devices and video surveillance systems, expanding the availability of real-time images and other data. For instance, as part of Leawood's computer-aided dispatch system, police, fire, rescue and other public safety personnel have GPS-enabled tracking devices in mobile units to view the exact location of all responders in the network, quickly deciphering which units are closest to the scene, ensuring a coordinated and timely deployment of responders.

By securely incorporating a video surveillance system into the wireless LAN, first responders can access real-time images and data to improve their situational awareness. In Spotsylvania County, Va., officials implemented a video surveillance network in local school buildings that is accessible to first responders via a secure municipal wireless network. With a private Web address and secure user authentication, the surveillance system provides a real-time view of common areas inside the local schools to authorized first responders through any standard Web browser.

Internet Protocol-based (IP) digital cameras stationed at strategic locations in the schools are connected to the schools' Wireless Local Area Network (WLAN) and then to the Internet and countywide wireless network. In the event of an emergency at a Spotsylvania school, first responders can access the video surveillance system from

ruggedized Itronix GoBook® Max laptops in their vehicles, which connect to the Internet via Sprint's 2.5G 56 kbps CDMA network.

With these new capabilities, law enforcement officials, regardless of their location at the onset of an incident, are equipped to quickly analyze hazardous situations and take decisive action, improving response time and saving lives. The other emergency responders, such as firefighters and EMTs, can view the secure video feeds and incident reports to understand the scope of the situation and more accurately select the tools and equipment necessary to address the incident. Tactically speaking, the fire lieutenant correctly decides to draw a wider attack hose and the EMT correctly decides to take a mass trauma kit.

### **Serving the Citizen**

The Internet has become an essential tool for 24/7 citizen access to government information and services, from driver's license renewals and fishing license applications to national park reservations and government tax filings. Despite the many significant advances, the full functionality and productivity improvements made possible by Web-enabled government have not been fully realized because service delivery is usually limited to citizens with Internet access in their homes, workplaces or at public facilities such as libraries. Municipal wireless networks enable greater utilization of existing services by allowing access wherever citizens are

and also facilitate the deployment of new services designed to improve public health, safety and transportation, to name just a few applications.

For example, coordination of traffic signal data with GPS bus location data, transmitted via wireless networks to a city transportation control center, can improve traffic flow and minimize mass transit delays. When delays do occur, citizens can be notified and advised of alternative routes via text messages sent to cell phones, PDAs or electronic roadside signs.

Wireless networks also improve citizen services by allowing government employees to complete tasks faster. In Kane County, Ill., the Coroner's Office has coupled mobile wireless technology with new software applications to create an automated paper system that cuts the time required to complete investigations by eliminating redundant data entry and allowing staff to file reports from the field.

Kane County's Coroner's Office Automation System (COAS) enables staff to capture hand-written data on Tablet PCs. The system transforms "handwritten" notes into typed documents, which are uploaded directly into the county database via a wireless network. By streamlining the data entry process, staff members are able to populate all forms by entering data only once. Through a secure wireless network connection, data moves from the Tablet PCs to the office within seconds, ensuring both information privacy and near-instant information access.

Previously, the Coroner's Office completed more than 150,000 paper forms each year. As a result, the 11-person Coroner's Office staff spent much of their time hand writing reports or entering data on aging computers with insufficient memory, processing speed and hard-drive space. Now, staff no longer must return to the office to complete multiple reports requiring redundant data entry, which means more work can be accomplished by the same number of personnel, and citizens learn the results of the Coroner's Office investigations in a more timely manner.

Other agencies are adopting paperless forms, such as benefits applications and traffic citations, to reduce operating costs and improve citizen service. By digitizing a benefit application, citizens can complete forms on their own time or government employees can help during preplanned visits to the citizens' homes. Police and parking authorities are now processing traffic citations faster with wireless handheld devices that scan driver's licenses, populate citations with relevant data and publish citations to mobile thermal printers.

In some cases, existing municipal wireless networks cover a central-city core or even larger area; Philadelphia, for example, is expanding its network from one hot spot in Love Park to cover the entire city. In Cleveland, citizens can access the Internet at more than 1,400 hot spots. In other cases, the networks bring access to citizens in remote communities where traditional wired Internet access is too expensive to

implement. In all cases, municipalities implementing wireless networks can bring services to citizens where they live, work, learn and play. A resident could then access the Internet from a library or in a city park to update his vehicle registration; another, accessing the Internet from her home, could complete forms for public health benefits for an ailing relative. A wireless network with access points throughout a public transportation system could provide continuous connectivity to commuters on trains, subways and buses.

### **Continuing Operations**

During major storms or other catastrophic incidents, power to critical IT systems can be disrupted, sometimes for hours or even days. In best-case scenarios, government agencies have established and tested continuity of operations plans in advance, minimizing downtime and data loss through data backup, redundant connectivity through wired and wireless networks and uninterruptible power supplies.

However, any disruption can wreak havoc on public safety, transportation and health operations, especially where IT systems are relied on to deliver real-time, mission-critical data to police, fire and emergency medical personnel; public transportation operators; and doctors and nurses.

These operations can afford system disruptions of only minutes, if any.

When natural disasters cause public switched telephone systems and other wired networks to fail, wireless networks can be used to carry mission-critical data. Municipal wireless networks operating separately from cellular towers and public switched telephone systems can enable constant communications between first responders and their command center if commercial lines are disabled or overloaded.

Mesh and partial mesh municipal networks ensure continuity of operations by providing redundant Internet feeds from multiple points, unlike an Internet connection fed from a single provider. A mesh or partial mesh network can be easily restored by connecting a few nodes — which is a much faster process than reconnecting every government building to the Internet.

Additionally, partial mesh networks can be set up on the fly to handle communications typically sent over wired lines and to establish temporary offices at remote sites overnight.

Ultimately, state, county and city governments are intelligently leveraging wireless municipal networks to enable better service and protection for their citizens.

## SOLUTIONS OVERVIEW

### Wi-Fi and Cellular Networks

Wi-Fi is the common term for networks built on the 802.11 wireless communications standard. A Wi-Fi network connects computers to each other, to the Internet, and to wired enterprise-wide networks. With a DSL, cable modem or wired Ethernet connection to the Internet and a Wi-Fi access point, employees are mobile within a contained area, such as an office. In settings such as office buildings and campuses, multiple base stations and antenna amplifiers are installed to provide coverage over a larger area. A typical Wi-Fi router has a range of about 150 feet indoors and 300 feet outdoors. When users leave the coverage area, they lose their network connection.

As a result, Wi-Fi is best used in defined areas, such as a city neighborhood or a campus of government buildings, where employees can move from office to office without having to shut down and restart their mobile computing devices. In a hospital, Wi-Fi can provide doctors and nurses with access to patient records from anywhere within the building.

Wi-Fi networks built on 802.11 standards require routers with dedicated Internet connection points deployed throughout a building or local community. If placed in an outside environment, these routers are commonly attached to a government-owned building or

sign within a weather-protected, secure case. In locations without 802.11 coverage, cellular networks are often leveraged in addition to the stationary routers, providing extended support for units that are more mobile.

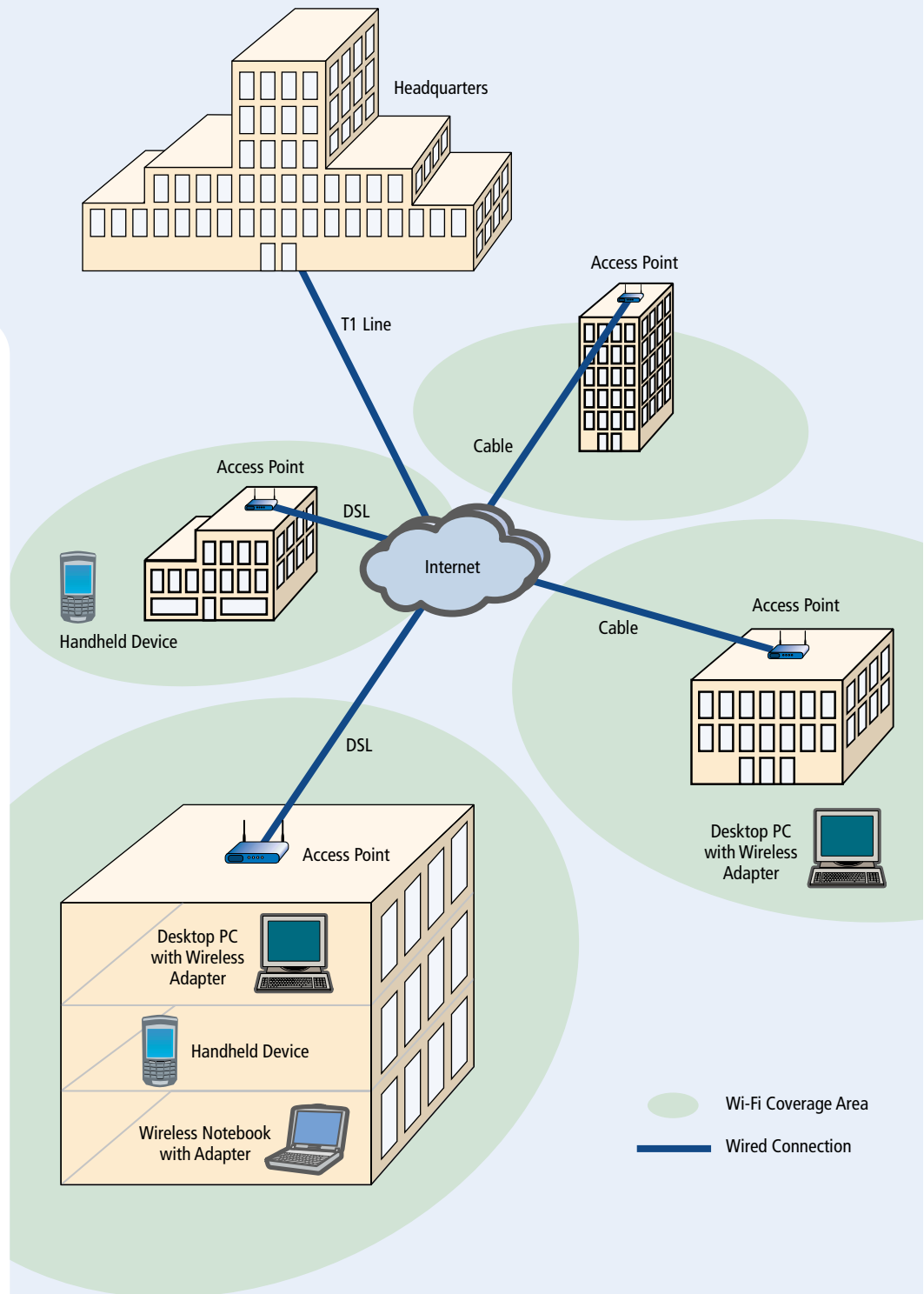
Similar to cell phone and PDA service, the cellular connection protocol (CDMA, GSM, e.g.) will determine network connection speeds, reception and coverage areas. With a broadband access card in each mobile computing device and payment of the monthly service fee to the cellular provider, employees can take advantage of Wi-Fi mobility over a much larger range, such as a 20-square-mile city center.

While cellular municipal wireless solutions do not require major upfront costs to set up towers and Internet connections, municipalities still must purchase cellular mobile access routers for each user's connection point and pay monthly fees for data services from the cellular provider. But for government organizations needing to upgrade from dial-up access, purchasing cellular access routers and wireless access cards for each wireless device on the network could cost half as much as deploying cable. In addition to the cost savings, the organization benefits from increased productivity realized by newly mobile employees, as well as the network's ability to scale less expensively to accommodate increasing numbers of users and applications.

## Wi-Fi Network

### Based on 802.11 standards

Wi-Fi access points distributed throughout each building provide secure Internet access to authorized mobile users nearby. Authorized users may access information stored in the headquarters through an Internet connection and custom extranet.



### **WiMax Networks**

A WiMax municipal area network, based on 802.16 standards, provides high-throughput broadband connections over long distances. A WiMax network can provide access in a linear service area of up to 30 miles and a data rate of up to 70 Mbps.

A WiMax network is based on a centralized, fixed Internet connection broadcasting a wireless Internet signal to multiple locations within the area. Commonly, the base station antenna is located on a rooftop or other tall structure, such as a water tower. The broadcast signal is then routed to a single computer via Ethernet cable, to a hotspot or a wired Ethernet LAN.

A WiMax network provides cost-efficient Internet access to the public by converging all connections into a single Internet connection. For that reason, local governments often use WiMax to establish hotspots in public buildings or neighborhoods, and businesses use WiMax to establish hotspots in high-traffic areas such as hotels and airports. Users are provided with secure logins and need a mobile access router or common Ethernet card to access the Internet.

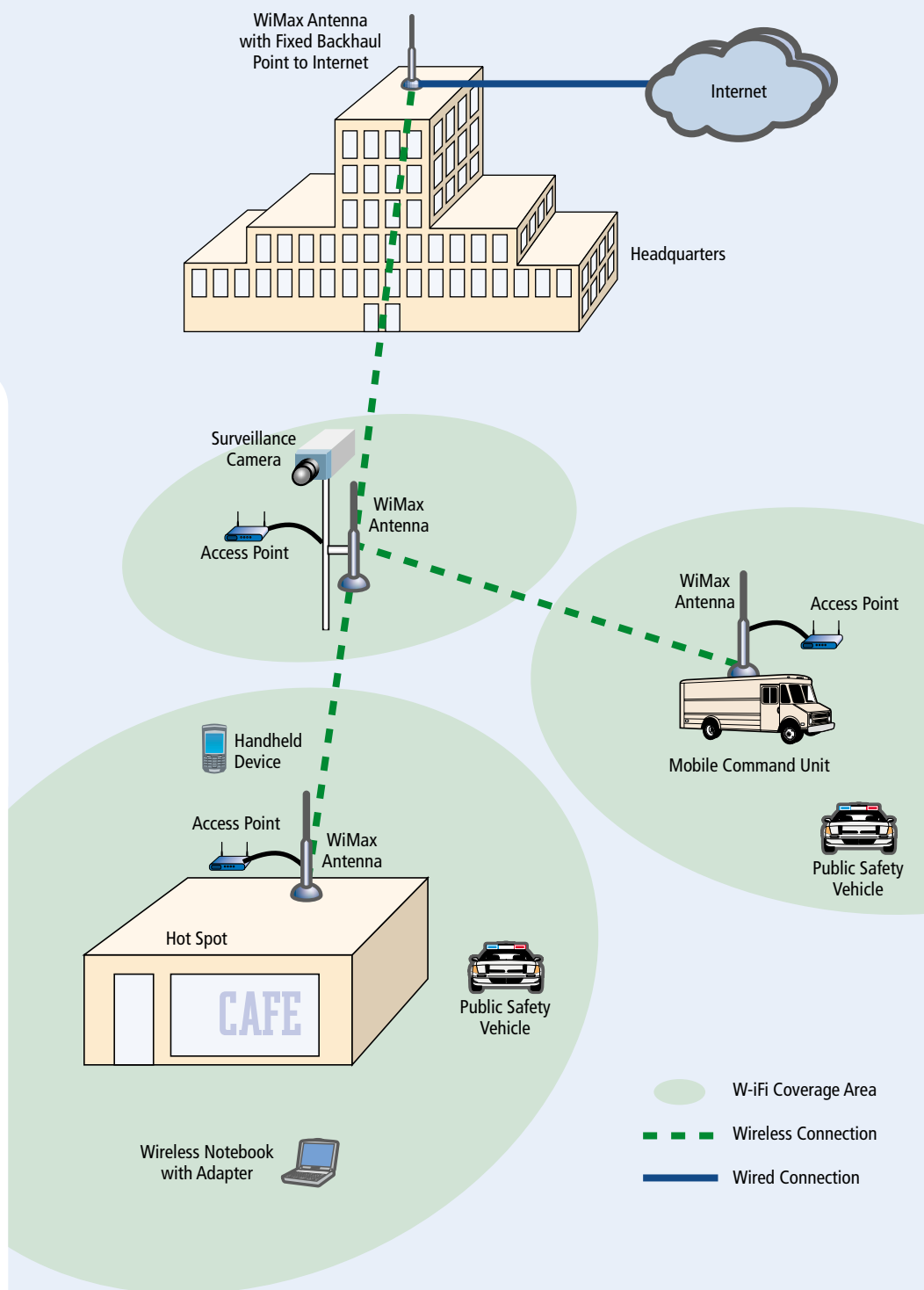
WiMax is an efficient alternative to DSL or cable broadband access where those services are either too expensive or not supported by the local infrastructure. It is also faster to deploy than cable or DSL, making WiMax a suitable choice for government agencies that have recently moved to new offices or need to set up remote offices quickly.

WiMax also is scalable for government organizations that need to quickly provide access to a large group of new users, such as first responders from across a region converging at a single location to aid in hurricane disaster response. Those users will need access not only to the Internet, but also will need access to government databases and communications systems. With WiMax, additional connections can be added on the fly to accommodate the surge in use, unlike wired broadband service providers. And like Wi-Fi networks, the coverage range of WiMax networks can also be extended by leveraging existing cellular networks where needed.

## WiMax Network

### Based on 802.16 standards

WiMax antennas atop buildings, mobile command units or other structures broadcast secure Wireless Local Area Network (WLAN) access to authorized mobile users. Authorized users within the coverage area can access centrally stored information or the Internet through the WLAN.



### **Mesh Networks**

A mesh network is a local area network (LAN) that employs one of two connection arrangements — full mesh or partial mesh. In the **full mesh network**, each computing device is connected directly to each of the others, supporting the LAN with multiple connectivity tunnels. In the **partial mesh network**, some devices are connected to all the others, while other devices are linked only to the devices with which they exchange the most data.

Wireless devices on the network that do not sense they have a direct connection to the network begin an automatic discovery process to identify the access points within range and create secure links to those access points. As additional devices are added, network routes are updated to connect those devices most efficiently, taking into account parameters such as traffic load, link speed and signal strength. This automatic process eliminates time-consuming configuration processes in the field.

Because the mesh network automatically derives the best access path for each device and adjusts on the fly for failed connections, it is especially suitable for

municipal government services typically delivered in the field, such as public health and safety operations and disaster response.

A full mesh network provides the highest probability of continuity of operations in a disaster situation. It offers the most redundant connection points to a building or remote user, enabling alternate routes for data packets if one or more connection points are disabled.

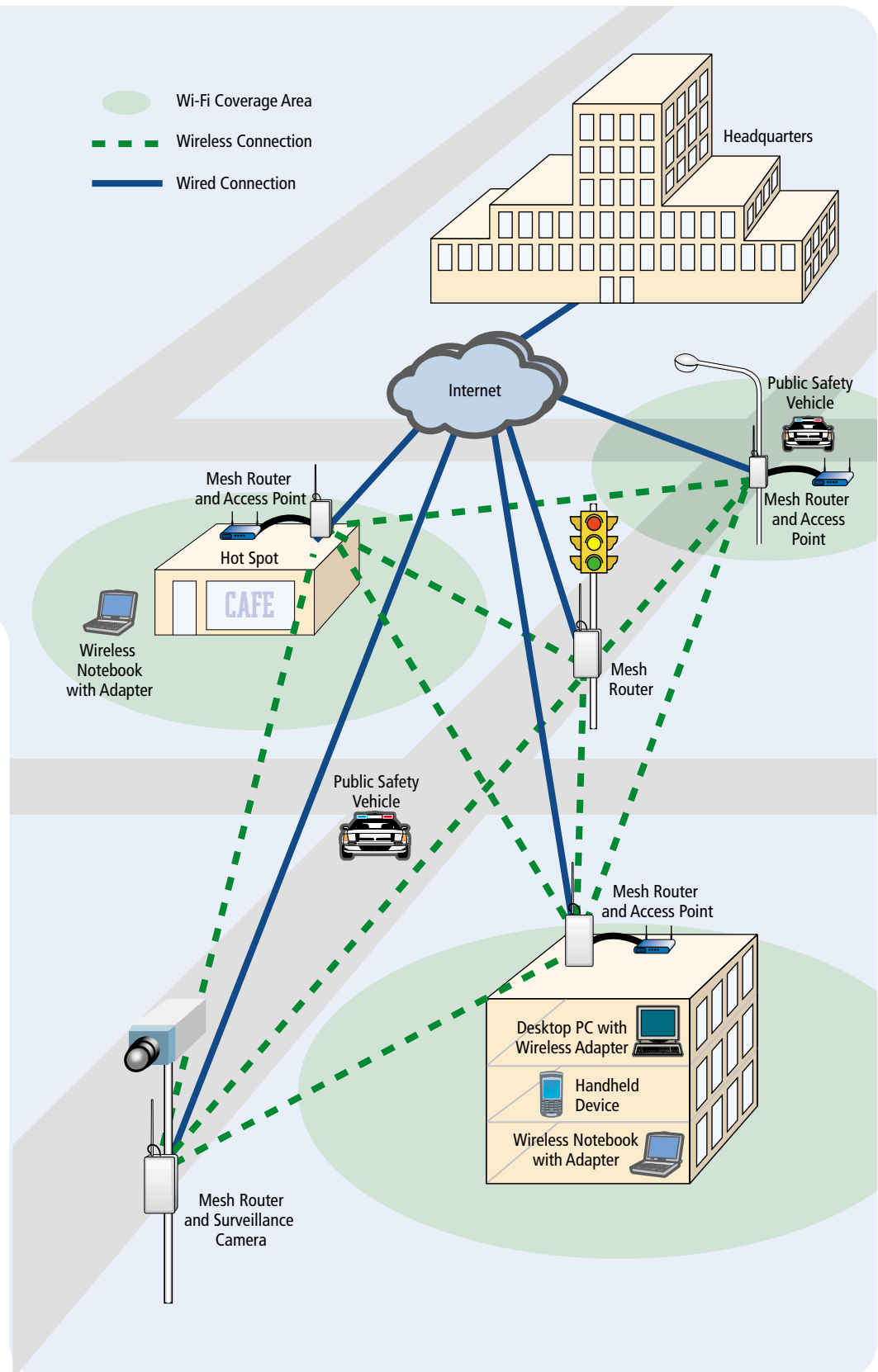
A partial mesh network offers redundancies that are similar to a full mesh network; however, a partial mesh network has fewer redundant connection points, leaving some buildings and remote users more vulnerable to failure in the event of a disaster.

Full and partial mesh networks both require local governments to install multiple Internet connection points and wireless antennas to maintain redundancies. A full mesh network is often more expensive than a partial mesh network because of its greater number of redundant connection points. Additionally, each remote user requires a mobile access router to connect to the network.

## Mesh Network

Based on Mesh Enabled Architecture (MEA) or Quadrature Division Multiple Access (QDMA) radio protocol

Mesh routers attached to buildings or other structures provide authorized mobile users with a comprehensive coverage area that spans large distances. Mesh routers allow redundant interconnections between access points, providing mobile users with multiple avenues to access centrally stored information or the Internet in the event of a nonfunctioning router.



## PARTNER SOLUTIONS



# Cisco 3200 Series Wireless and Mobile Routers

## Product Overview

With a ruggedized, compact form, Cisco 3200 Series routers are ideally suited for interconnecting remote vehicles and outdoor locations to a municipal wireless network.

When deployed as outdoor wireless infrastructure in a municipal mobile network, the Cisco 3200 Series routers can be used to create broadband wireless coverage areas that can be interconnected across a citywide geography. Acting as access points or nodes, each Cisco 3200 Series router placed at a fixed point can provide service to vehicles or authorized users within the coverage area.

Cisco 3200 Series routers also extend wireless service when deployed in vehicles or mobile units. With the router's built-in Wireless Mobile Interface Cards (WMIC), the vehicle becomes another node, increasing the coverage area.

## Features

Cisco 3200 Series routers support multiple standards, including 802.11b/g and 4.9 GHz, allowing connectivity for transferring data, voice, and video across partial mesh and mesh networks.

In addition, Cisco 3200 Series routers operate on a layer 3 communication model. This multilayered communication model ensures quality of service and continuity of operations by interconnecting nodes through multiple channels. With layer 3 communication, data transmission speeds remain consistent even if service must be routed through longer channels.

Cisco rugged enclosures fulfill specific physical and environmental deployment requirements for public safety, homeland security, transportation and defense applications. Designed for both in-vehicle and outdoor use, Cisco's rugged, sealed enclosures withstand harsh environments, such as damp, wet and dusty climates, as well as intense vibration.

## Technical Specifications

**WAN and LAN Connections:** IEEE 802.11b, IEEE 802.11g, 4.9 GHz

**Frequency Band:** 2.4 GHz or 4.9 GHz

**Data Rate:** Supports up to 54 Mbps

**Dimensions:** Height: 5.89 inches; Width: 6.82 inches; Depth: 7.80 inches

**Weight:** 14.5 lbs.

**Temperature Range:** -40 to 85°C

**Bundle Includes:** 1 Fast Ethernet Switched Mobile Interface Card (FESMIC);

1 Serial Mobile Interface Card (SMIC); 1-3 Wireless Mobile Interface Cards (WMICs) with either 2.4 GHz WMIC-802.11b/g or 4.9 GHz WMIC-4.9 GHz bridging/access-point functions; and 1 Mobile Access Router Card (MARC)

## Motorola MEA™/QDMA® Product Line

### EWR 6300 — Enhanced Wireless Router

#### Product Overview

Motorola's mesh networking technology enables users to wirelessly access critical broadband applications anywhere, at any time. High-speed data is provided via predeployed infrastructure, or by creating an instant, ad hoc, broadband mesh network with other users capable of delivering real-time data to detect, prevent and respond.

#### Features

The Motorola Enhanced Wireless Router (EWR) delivers coverage in large geographic areas, while providing wireless network access to one or more IP devices via its built-in RJ45 Ethernet port. The EWR efficiently combines the functionality of a Mesh Enabled Architecture (MEA) Wireless Router and client modem in a single,

cost-effective, wireless network component. This makes it easy for any Ethernet-ready device to access an MEA mobile broadband network. Computers, IP video cameras, sensors, signs and signals can all be mesh-enabled to send and receive data at burst rates of up to 6 Mbps. All of the standard wireless router capabilities, including multi-hopping, non-line-of-sight communications and position location services, are fully supported.

The Motorola EWR also supports three IP addresses, allowing a network of end-user devices to be addressed and managed over the MEA network. Four or more devices can be supported by simply adding a Network Address Translation (NAT) router to the client network.

In addition, new features and services can be added via over-the-air software downloads, simplifying network maintenance and improving network management.



### Technical Specifications

**WAN and LAN Connections:** QDMA, Mesh Enabled Architecture

**Frequency Band:** 2.4 GHz

**Data Rate:** 1.5 to 6 Mbps (depending on configuration)

**Dimensions:** Height: 6.25 inches; Width: 6.25 inches; Depth: 4 inches (without antenna)

**Weight:** 4.4 lbs.

**Temperature Range:** -35 to 55°C

**Network Information:**

- Network Interface: 10/100 Mbps Ethernet, RJ45
- Network Management: Motorola MeshManager® via Simple Network Management Protocol (SNMP)
- Configurable: 3 assignable IP addresses

## Proxim Wireless Networks Multipoint

### Tsunami Multipoint Units with 60 Mbps (110/220V)

#### Product Overview

The Proxim Tsunami Multipoint system is a point-to-multipoint outdoor wireless system offering a high-capacity, reliable alternative to wired data networks. Using IP packet radio transmitters, standard Ethernet interfaces, and an easy-to-deploy design, the Tsunami Multipoint system enables high-speed network connections to multiple Ethernet switches, routers or PCs from a single location. The systems consist of one or more Subscriber Units (SUs) that communicate with a Base Station Unit (BSU).



#### Features

Proxim Tsunami Multipoint has been specifically designed to counteract interference from various consumer wireless devices. Tsunami BSUs are equipped with Active Interference Rejection (AIR) technology to ensure that the wireless link remains reliable even in crowded, urban areas.

Voice over Internet Protocol (VoIP) support built into Proxim Tsunami Multipoint also enables service providers to offer both voice and data services to SUs, while still maintaining connection of up to 60 Mbps.

In addition, Proxim Tsunami Multipoint specializes in traffic prioritization with algorithms and Virtual Local Area Network (VLAN) functionality that enables latency-sensitive application performance management.

#### Technical Specifications

**WAN and LAN Connections:** IEEE 802.1D; IEEE 802.1Q

**Data Rate:** 60 Mbps

**Frequency Band:** 5.8 GHz

**Dimensions:** Height: 10.5 inches; Width: 10.5 inches; Depth: 6.8 inches

**Weight:** 10 lbs.

**Temperature Range:** -25 to 55°C

#### Network Information:

- Network Interface: 10/100 Mbps Ethernet, RJ45 Connector
- Virtual Local Area Network (VLAN) support
- Patented Active Interference Rejection (AIR) technology, which uses a preprocessing filter to nullify interference

## Panasonic Toughbook-18

### Ruggedized Wireless Notebook/Tablet PC

#### Product Overview

Panasonic Toughbooks® are powerful, portable and extremely versatile, with wireless-ready capabilities and an integrated Global Positioning System (GPS). Panasonic Toughbooks have been ruggedized inside and out to protect screens, cases, keyboards and hard drives from drops, liquid spills and falling objects — the three leading causes of notebook damage. Further, with damage-resistant Panasonic Toughbooks, government officials spend less time transferring data from impaired systems, recovering lost work, hiring expensive IT consultants and replacing failed notebooks.



#### Features

With one quick swivel, the wireless Panasonic Toughbook-18 transforms from a fully-rugged, maximum-performance notebook PC to a fully-rugged, handwriting-friendly tablet PC. With this versatile wireless notebook, government officials can take handwritten notes, mark and edit documents, as well as draw diagrams. In addition, the notebook automatically converts handwriting to typewritten text.

Specifically designed for the most rugged conditions, the Toughbook-18 is well suited for the field conditions of mobile units. The notebook is also equipped with a touchscreen monitor that is optimized for viewing data in outdoor environments, allowing mobile government workers to bypass the keyboard and easily interact with data through customizable, user-friendly graphical interfaces.

#### Technical Specifications

**Processor:** Intel® Centrino™ Mobile Technology

**O/S:** Microsoft® Windows® XP Tablet PC Edition 2005

**Monitor:** 10.4 inches XGA TFT LCD; Touchscreen

**Connections:** Integrated 802.11a/b/g wireless LAN; Bluetooth™; Global Positioning System (GPS) receiver

**Dimensions:** Height: 1.9 inches; Width: 10.7 inches; Depth: 8.5 inches

**Weight:** 4.6 lbs.

#### Rugged Features:

- Full magnesium alloy case with handle
- Moisture- and dust-resistant monitor, keyboard and touchpad
- Sealed port and connector covers
- Shock-mounted hard drive in stainless steel case